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Highway and Rapid Transit Problems in Boston

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Volume XII SEPTEMBER, 1925 Number 7

THE RAPID TRANSIT SYSTEM OF NEW YORK CITY

By Robert Ridgway*

(Presented February 20, 1925, at a joint meeting of the Boston Society of Civil Engineers and the Northeastern Section, American Society of Civil Engineers)

I suppose the highest compliment that can be paid to a speaker is to ask him to come again, so I feel particularly flattered by the invitation of Mr. Rogers to address you this evening on the subject of "The Rapid Transit System of New York City," because I had the honor of reading a paper before the Boston Society of Civil Engineers in March, 1918, and having it published in the Society's Journal (May, 1918). In that paper I outlined, in a general way, the rapid transit system of the city and the progress of construction under the so-called Dual Contracts, which were then nearing completion.

Perhaps I should explain, in order to avoid confusion, that the term "Dual Contracts" refers to the contracts made in March, 1913, by the city of New York, acting by the Public Service Commission for the First District of the State, with the two great operating companies of the city. Contract No. 3 was with the Interborough Rapid Transit Company, and Contract No. 4 with a subsidiary of the then Brooklyn Rapid Transit Company, since reorganized and known as the Brooklyn–Manhattan Transit Corporation. These contracts provided for the construction of certain new lines, mostly at the city's expense, and all of them to be city owned; for combining them with the then existing rapid transit lines, subway and elevated; and for each company to operate its system as lessee for a term of forty-nine years. Fig. 1 is a bird's eye view of New York showing the lines of rapid transit railroads operated under the Dual Contracts. To better visualize their extent, they are also shown in Fig. 2, superimposed upon the map of Boston.

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* Chief Engineer, Board of Transportation, New York City; President, American Society of Civil Engineers.

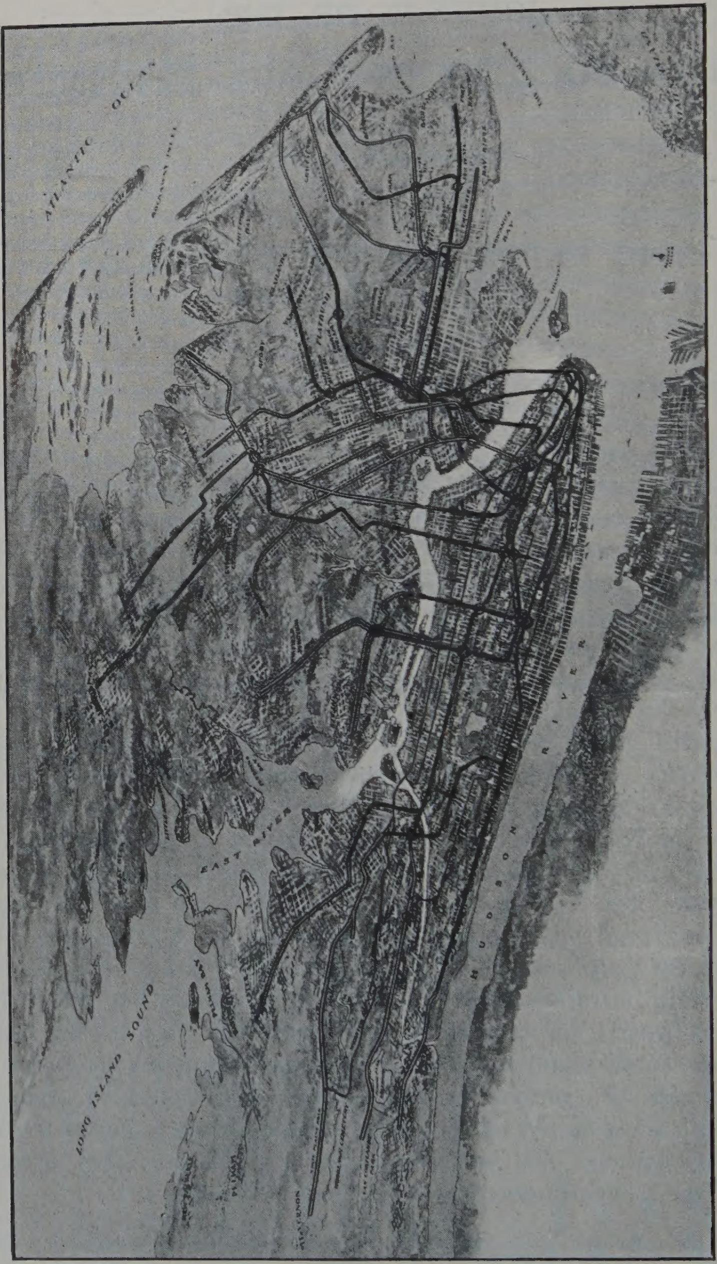

FIG. 1. — BIRD'S-EYE VIEW OF NEW YORK CITY, SHOWING RAPID TRANSIT LINES OF DUAL SYSTEM

Under the arrangements with the Interborough Company, under the Dual Contracts, the receipts were to be pooled, and from the gross revenues there was to be deducted and paid, in the order named (deficits to be cumulative with compound interest) —

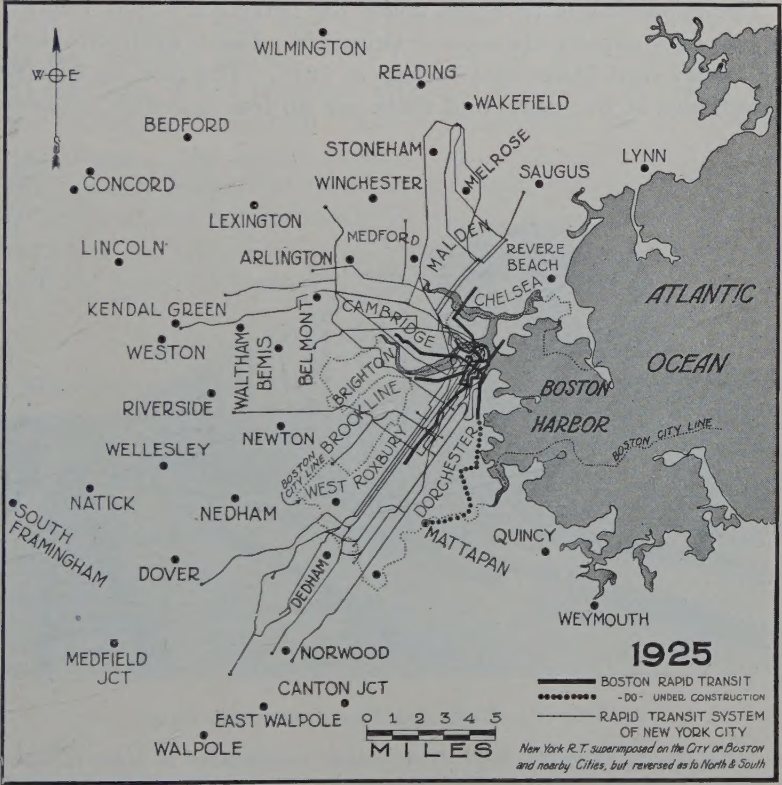

Fig. 2. — Rapid Transit Lines of Dual System in New York Superimposed upon the Map of Boston to Indicate the Area Served

(*a*) Operating expenses; provision for depreciation, renewals and obsolescence; taxes, insurance and rentals payable to the city under existing subway contracts.

(*b*) A sum to be retained by the company amounting to $6,335,000 per annum, representing the average annual income received by it from the operation of the existing subway lines and equipment for the two fiscal years ending June 30, 1911.

(*c*) A sum to be retained by the company equal to 6 per cent per annum upon the new investment of the Interborough Company in the new lines, estimated at $80,000,000, or $58,000,000 for new construction and $22,000,000 for new equipment.

(*d*) To be paid to the city the interest and sinking fund upon the bonds issued by the city for the construction of new lines, and in addition such further sum as will bring the payments to be made to the city up to an amount equal to 8.76 per cent upon its expenditures.

(*e*) Any amount remaining to be divided equally between the city and the company, share and share alike.

The disposition of revenues under the Brooklyn Rapid Transit contract was substantially the same in principle. This is outlined more fully in my paper read before the Society in 1918. The fare, as specified in the contracts, is five cents and there are no free transfers between the services of the two companies, nor is there any free transfer between the rapid transit lines and the surface lines except at one point in Brooklyn. There is likewise no free transfer between the Subway and Elevated divisions of the Interborough System, except at 149th Street and Third Avenue in the Borough of The Bronx. The Elevated division of the Interborough comprises the company-owned lines of the old Manhattan System, and the Subway division includes the city-owned subways and their elevated extensions. One may ride on these lines a maximum distance of about 27 miles for one five-cent fare. The five-cent fare has become a slogan and has been the subject of much discussion in the

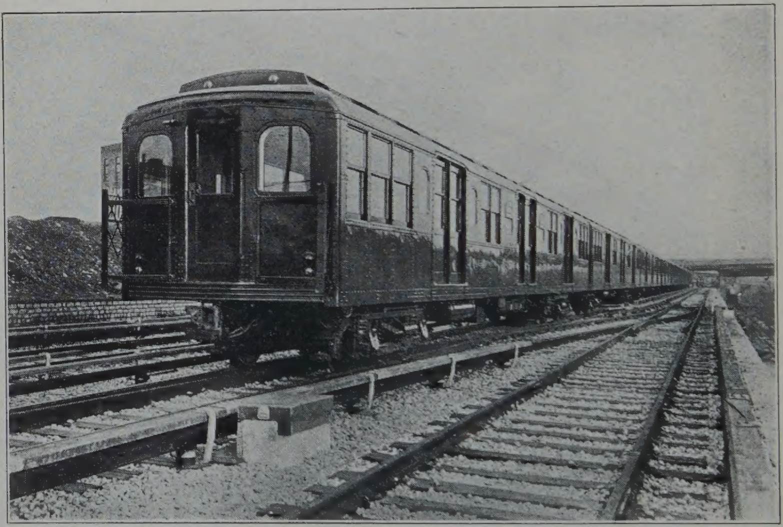

FIG. 3. — EIGHT-CAR TRAIN OF STEEL CARS

Operated by Brooklyn-Manhattan Transit Corporation in rapid transit service press and on the political platform. In a way, it is unfortunate that this is so, because the discussion has led to a great deal of bitterness of feeling and adds to the difficulty of dealing with an already complicated situation.

The steel cars of both operating companies represent a very high order of equipment, and they are provided with many devices to safeguard the traveling public. The cars of the Interborough Company are 51 feet long, 8 feet 10 inches wide and seat 44 to 46 people. Those of the Brooklyn–Manhattan Transit Corporation are of later design and also larger; the length being 67 feet, the width 10 feet and the seating capacity from 78 to 90, when all seats are in use. The maximum train length on the Interborough System is 10 cars, and on the Brooklyn–Manhattan Transit System, 8 cars. Fig. 3 is a view of an 8-car train of the Brooklyn Company.

MILEAGE OF THE RAPID TRANSIT SYSTEM.

The mileage of the lines to be operated under the Dual Contracts Nos. 3 and 4 includes 222.4 route miles and 625 track miles, divided as follows:

MAIN TRACK AND ROUTE MILEAGES UNDER DUAL SYSTEM
Operated to Date

ROUTE MILES	Contract No. 3 (Interborough Rapid Transit)	Contract No. 4 (Brooklyn-Manhattan Transit)	Total, Contracts Nos. 3 and 4
Subway	43.8	24.8	68.6
Elevated*	71.2	59.1	130.3
Open	0.4	15.5	15.9
Totals	115.4	99.4	214.8

TRACK MILES	Contract No. 3 (Interborough Rapid Transit)	Contract No. 4 (Brooklyn-Manhattan Transit)	Total, Contracts Nos. 3 and 4
Subway	129.9	71.8	201.7
Elevated*	202.2	150.8	353.0
Open	1.2	51.7	52.9
Totals	333.3	274.3	607.6

Above tabulation does not include crossovers, sidings, yards and shops.

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* Elevated includes bridges.

Lines not yet in Operation

LINE	Length of Route (Miles)	Number of Tracks	Contract
14th Street–Eastern Extension	3.6	2	4
Nassau Street Line	1.1	2	4
Fourth Avenue Extension (86–95)	0.4	3	4
Queensboro Subway (extension)	0.7	2	3
Flushing Extension	1.8	3	3 and 4
Total	7.6	–	–

NOTE. — Tabulation of route and track mileages in Contract No. 3 includes the old Subway built under Contracts Nos. 1 and 2, consisting of 19.3 miles of subway and 6.2 miles of elevated routes with 54.5 miles of subway and 17.9 miles of elevated main tracks.

All of these lines are now in operation except about 7 route miles. The cost of construction of these two systems, exclusive of the cost of the privately owned lines of the old Manhattan Elevated structures in Manhattan and The Bronx, and the other privately owned lines of the two companies is over $450,000,000. In addition, over $130,000,000 has been spent by the two companies for equipment and for improving and extending the lines owned by the companies.

These figures are very impressive, compared with other large construction projects. The cost of bringing the supply of water to the city from the Catskill Mountains, 100 miles away, with the appurtenant work, amounted to about $185,000,000, and the cost of constructing the Panama Canal was about $400,000,000. The transit construction could not be reproduced for anything like this figure to-day, since most of the work was done at pre-war prices.

There is one thing on which all parties appear to be united, — that is, that whatever rapid transit lines may be built in the future they must be municipally owned. I do not believe that any consideration would be given to a proposition for building privately owned local transportation lines in the city. It is possible, however, that subways may be built by private companies for bringing suburban passengers into the lower parts of the city from Westchester County and from New Jersey and Long Island. Tentative plans have been made for doing this, but they are not yet far enough advanced or definite enough to bring to the front the question whether they shall be privately or publicly owned.

CONTROL OF CONSTRUCTION AND OPERATION

While there is no question about the public ownership of the local transit lines, there is a decided difference of opinion on the question of operating them. The two public bodies having officially most to do with the question — that is, the State Transit Commission and the city's Board of Transportation — are on opposite sides of the question.

The situation is so complicated that perhaps a short explanation of the organization of the bodies having to do with these questions will make it a little clearer. The original subways, on which construction was begun in 1900, were built under the direction of a commission appointed under an act of the Legislature, known as the Rapid Transit Railroad Commission. This was a self-perpetuating body, that is, if one member dropped out, the others appointed his successor. However, the city was represented on this Board by the mayor and the comptroller, they being ex-officio members. This body remained in office until 1907 and accomplished the building and the beginning of operation of the first city-owned rapid transit railroad of the Interborough System, known as Contracts Nos. 1 and 2, the lines of which extended from the northerly section of The Bronx to the heart of the business section of Brooklyn.

In 1907 this body was superseded by the Public Service Commission for the First District, organized under Governor Hughes' public utilities law. This Commission consisted of five members, each holding office five years, one Commissioner's term expiring on February first of each year. It had to do, not only with rapid transit construction, but was charged with the regulation of railroads and other public utilities within the limits of the city, except telephones, which were under the jurisdiction of the Commission for the Second District. Under this Commission, the Dual Contracts were executed in March, 1913, and the program of work under those contracts was brought to an advanced state of completion. As the terms of the various members expired their successors were appointed by the Governor.

The Commission thus changed its personnel from time to time until, in 1919, it was abolished by act of the Legislature and a new commission of one member was substituted for it, having to do with regulatory work only. The construction activities were in the same year transferred to a Transit Construction Commissioner, a State officer, appointed by the Governor under an act of the Legislature of the same year, to carry on the work of construction provided for in the Dual Contracts. He, in turn, was superseded in the spring of 1921 by the Transit Commission, consisting of three members, and provided for in the Legislature of that year. This Commission took over not only the construction work of the Transit Construction Commissioner, but also the regulatory powers of the Public Service Commission for the First District over railroads within the city of New York.

The Rapid Transit Law was again amended in 1924, taking away from the Transit Commission the construction work, and transferring it to a Board of Transportation, of three members to be appointed by the mayor of the city. These Commissioners were appointed and assumed charge on the first of July, 1924, the Transit Commission still retaining its regulatory powers.

As the organization stands to-day, therefore, there is a Transit Commission of three members, appointed by the Governor of the State, having regulatory powers over the railroads within the limits of the city, including local transit lines, and a Board of Transportation of three members, appointed by the mayor of the city, responsible for construction of any new rapid transit lines that may be built, with their equipment and operation. The latter Board also has supervision of the construction of the unfinished portions of the Dual Contract lines, together with any new construction in the way of additions or extensions of these lines that may be ordered by the Transit Commission.

All contracts for construction, before becoming effective, require the approval of the Board of Estimate and Apportionment of the city, which also appropriates the money for carrying out the contracts. This requirement dates back to the early days of the Public Service Commission, and, where there is a difference of opinion between the two bodies on any question relating to a particular contract as to its execution, the contract is apt to be held up and there is delay.

The Board of Estimate and Apportionment consists of eight members, all elected officers: the mayor, the president of the board of aldermen and the comptroller, each with three votes; the presidents of the Boroughs of Manhattan and Brooklyn, each with two votes; and the presidents of the remaining boroughs of The Bronx, Queens and Richmond, each with one vote, — 16 votes in all. Under the so-called Home Rule Act, passed a year ago, the government of the city is in the Municipal Assembly, which consists of the Board of Estimate and Apportionment and the Board of Aldermen. The latter body, however, has nothing to do with the approval or carrying out of rapid transit construction contracts.

There has been considerable friction between the State and the city authorities over the transit problem. The city authorities maintain that since the problem affects the city primarily, and the city pays the bills, the State should turn over not only the construction powers that are now vested in the city, but the regulation of the railroads as well, and this, likewise, has been made a political issue.

CHANGES PROPOSED BY THE TRANSIT COMMISSION

The Transit Commission, after it assumed office, in 1921, set about making a valuation of the transit properties of the companies, both rapid transit and surface lines. That report was completed February 15, 1922, and public hearings were held regarding it. In September, 1921, the Commission also formulated and published a "Statement and Outline of a Proposed Plan of Readjustment of the New York City Street Railroads, rapid transit and surface, in which the following principles are stated:

(*a*) Municipal ownership of all railway lines in the city of New York.

(*b*) The surrender by the companies of all existing franchises, including perpetual franchises.

(*c*) The elimination of all existing agencies as factors in the transit situation.

(*d*) The unification of the entire transit system, with a Board of Control, three members to be appointed by the mayor, three by the investors, and a chairman to be selected by the two groups.

(*e*) Operation to be carried on by three operating corporate agencies to be created for the purpose.

(*f*) Genuine home rule by the city in the administration of its transit affairs.

(*g*) The elimination of stock speculation in transit facilities, by the elimination of stock.

(*h*) An honest valuation of all properties to be taken over by the city.

(*i*) Payment for such property to be made on the basis of such valuation, irrespective of present capitalization and book values.

(*j*) Municipal ownership to be acquired without outlay by the city, by retiring the purchase bonds, out of revenues of operation.

(*k*) No increase of fare unless operation under the new conditions demonstrate its necessity.

(*l*) Rates of fare to be based on actual cost and automatically determined by the amount of a contingent reserve or "Barometer" Fund.

(*m*) Substantial economies in operation of the unified system through consolidation and the elimination of the numerous leasing and operating companies, with their unnecessary duplication of overhead, separate traction policies and independent purchases.

(*n*) Consolidation and unification of power facilities.

(*o*) The elimination of preferential payments to existing companies and the placing of the city's rights on the same footing with those of other interests.

(*p*) The assurance of a fair return on securities of the new system.

(*q*) The re-establishment of free transfers as rapidly as the financial condition of the new system will permit.

(*r*) The increase of the city's debt-incurring capacity so as to permit new subway construction.

(*s*) Proper and adequate service to the public.

(*t*) The rehabilitation of required lines, and the elimination of obsolete facilities.

(*u*) Participation by operating personnel, as well as new security holders in surplus profits resulting from efficient management and operation.

(*v*) Useless or broken down lines not needed in the public service, not to be included in the system.

Public hearings were likewise held on this plan which, however, has not received the support of the city government. In other words, the Transit Commission is behind the proposition for the unification of all of the local transportation lines, these lines to be owned by the city and to be operated by private companies under public control. The city authorities, on the other hand, favor not only public ownership of the railroads but their public operation. To this end they would recapture such parts of the existing rapid transit lines as would fit in with their schemes in accordance with the recapture provision of the Dual Contracts. The physical plan of the Transit Commission, broadly speaking, was to expand the existing rapid transit lines as far as that could be done, and to build such other new trunks and branches as might be needed. The plan of the City Board of Transportation is for an entirely new system of rapid transit lines, with no connection to the present systems except such portions of the latter as may be recaptured by the city. While there is no radical difference of opinion between the two bodies as to the physical layout of the new lines, the plans are diametrically opposed as far as operation of the lines is concerned.

The Transit Commission submitted a plan in May, 1922, for the immediate construction of 33 miles of new routes, with about 84 miles of single track, estimated to cost approximately $230,000,000. With the exception of 5.5 miles of route, which cover extensions of existing lines, none of the construction has been undertaken, as no understanding was reached with the city authorities regarding it.

Under the direction of the new Board of Transportation, plans are being made for the new lines, and construction contracts are being rapidly advanced. Bids were recently received for two contracts of the so-called Washington Heights Line in Manhattan, amounting to a total of over $9,500,000, covering about 5,575 linear feet of four-track subway, and the contracts have been awarded to the low bidders. The compre-

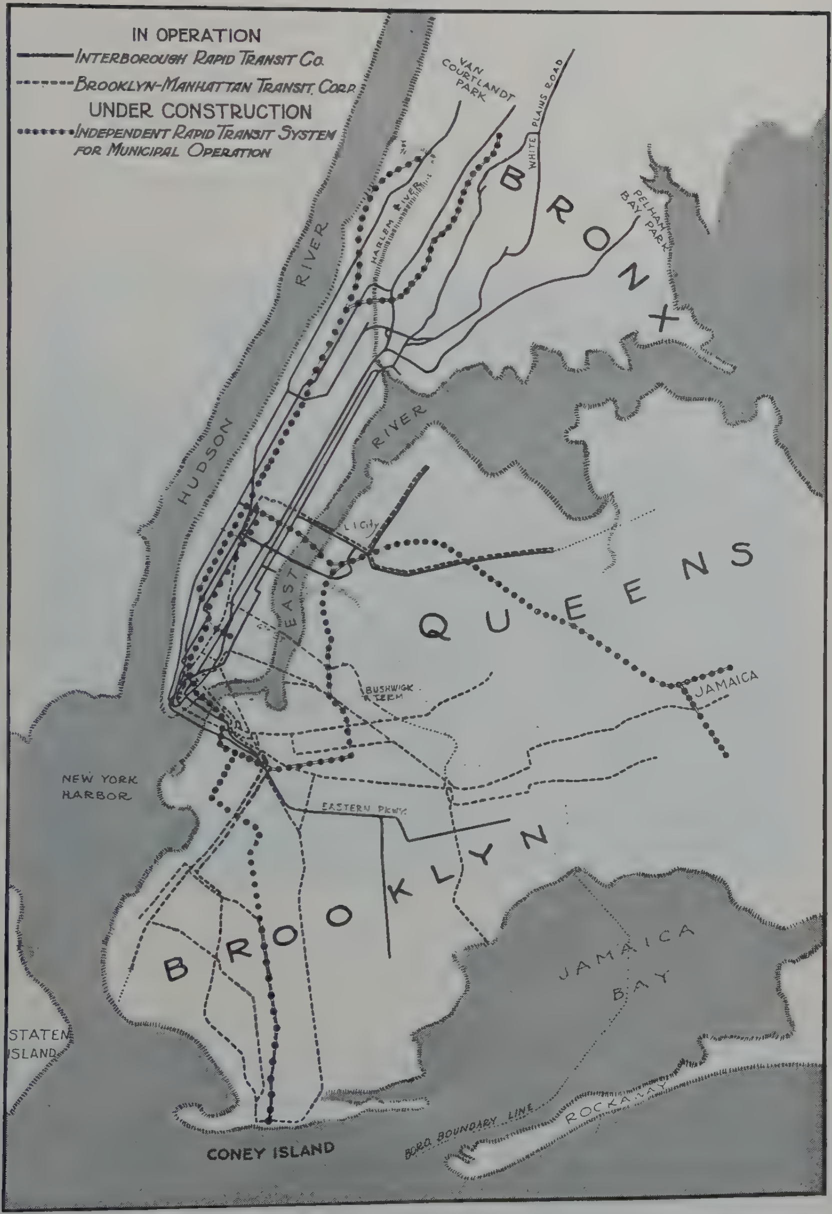

Fig. 4. — Map showing Location of Proposed Rapid Transit Lines for Municipal Operation and their Relation to the Company-operated Lines of the Dual System

hensive plan calls for a two-track loop line taking in the business and residential section of Central Brooklyn and the west side of Manhattan below 53d Street. Two tunnels are required for this line under the East River, one at 53d Street and the other near the lower end of Manhattan. Tangent to the loop, and paralleling or connecting with it, are trunk lines, one extending to and through the Washington Heights section of upper Manhattan; a second from Long Island City, Queens, easterly through that Borough and to Jamaica; and a third extending from down-town Brooklyn to a connection with the, so-called, Culver Line of the Brooklyn–Manhattan Transit System, which it is planned to recapture, thus providing a line to Coney Island. Included in the plan are 57 route miles and 170 single track miles. The estimated cost of construction is approximately $375,000,000. The equipment will cost about $102,000,000 more. The administration and engineering expenses on these two items will amount to $30,000,000 additional,

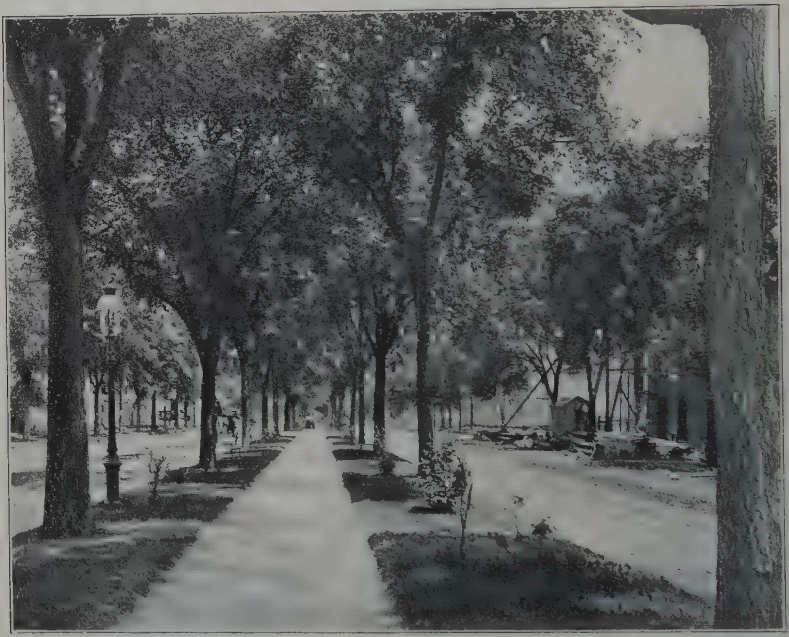

Fig. 5. — Broadway at 120th Street in 1900
Showing character of development as of that date (compare with Fig. 6)

giving a total approximate cost of $507,000,000. Fig. 4 shows the general layout of the proposed new lines, and also their relation to the lines of the Dual Systems.

METHOD OF FINANCING

It is obvious that all of the cost of new construction by either plan cannot be paid for out of bonds issued within the present debt limit which the comptroller of the city recently estimated to be in the neighborhood of $33,000,000. The increased assessment of next year is expected to add about $75,000,000 to this, making the amount available for subway construction in 1926 about $108,000,000. However, all of the construction cannot be done at once, and with increased assessments from year to year the debt incurring capacity is extended. The matter of financing the new lines, therefore, is a matter requiring considerable study by those in authority.

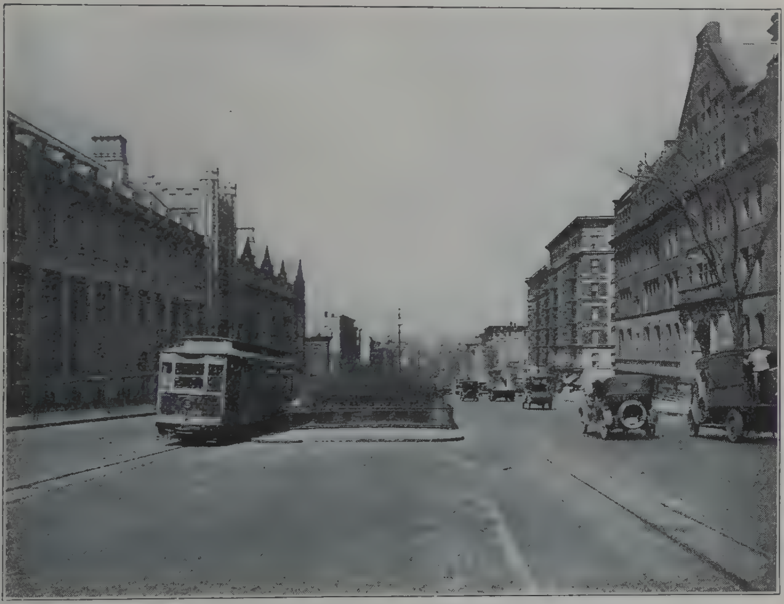

FIG. 6. — BROADWAY AT 120TH STREET IN 1925
Showing character of present development (compare with Fig. 5)

The increase in assessed valuation of property in any growing section of the city may be considered a certainty, and the provision of rapid transit lines is a great factor in causing such an increase. This is well illustrated by Figs. 5 and 6, which show the conditions along Broadway at 120th Street, in 1900 and to-day, respectively, representing the period since beginning the construction of the first subway.

The Board of Estimate and Apportionment is advocating the passage of a constitutional amendment which will permit the exemption of $275,000,000 of bonds from the debt limit of the city. This limit is 10 per cent of the assessed valuation, except bonds which may be issued for water supply and those bonds that are made exempt because they represent investments that are self-sustaining. Under the latter provision of the law, the bonds for the construction of the first subways and certain dock bonds are not counted in reckoning the debt limit, they being self-sustaining. Such an amendment will require passage through two succeeding Legislatures and also favorable action by a

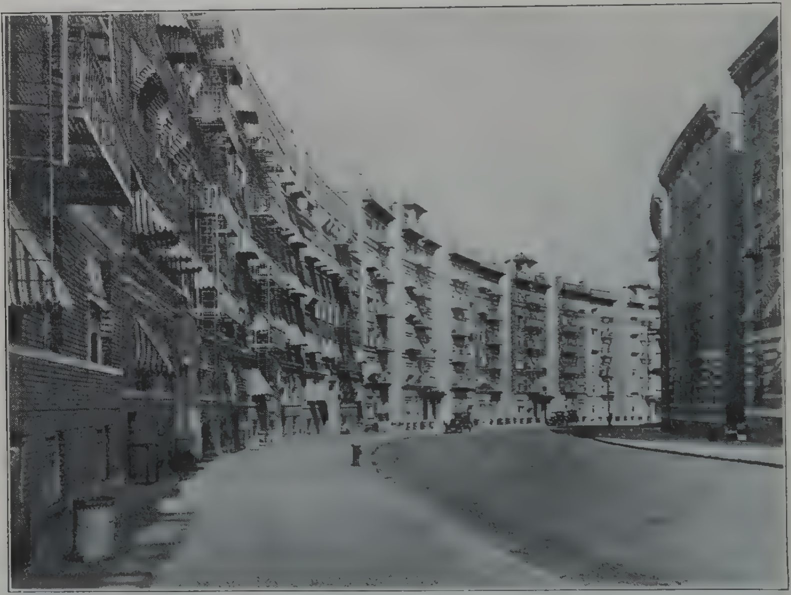

FIG. 7. — TYPE OF APARTMENT HOUSES COMMON TO NORTHERN MANHATTAN

referendum by the people, and cannot become effective until 1928, at the earliest.

The greatest source of traffic lies in the apartment house areas, and while there are such areas in all the boroughs, they are practically general throughout all of Manhattan except the extreme lower portion. Fig. 7 is a view showing some recently constructed apartments which are of the type common to northern Manhattan.

The area, total population, density of population per acre, and the assessed valuation of property in each of the Boroughs of the city are as shown by the following table:

BOROUGH	Area in Square Miles	1920 Population	1920 Density per Acre	1923 Assessed Valuation — Real and Personal Property
Manhattan	22	2,284,103	162.2	$6,350,715,668
Bronx	39	732,016	29.3	993,506,343
Brooklyn	81	2,022,262	39.0	2,677,382,351
Queens	121	466,811	6.0	877,754,599
Richmond	57	115,959	3.2	161,462,287
Total	320	5,621,151	27.44	$11,060,821,248

Prior to the war, a rule of thumb estimate of the cost of constructing subways in such locations as that of central Manhattan, near 34th or 42d streets, was $1,000,000 per track mile. Now the cost has more than doubled. In other words, we must pay at least $2,000,000 per track mile of subway in the same location. Naturally, the cost varies according to local conditions. As an illustration, prior to the war these costs ranged from about $700,000 per track mile for a section in South Brooklyn to $2,500,000 per track mile for a two-track line in William Street, in lower Manhattan, where approximately one-third of the cost of construction was absorbed in the underpinning, protection and maintenance of abutting buildings.

The distribution of cost to different parts of the construction is shown by the following table, which shows the average percentages derived from those of 57 different subway contracts:

Item	Percentage of Cost
Earth excavation	25.6
Rock excavation	15.9
Concrete	14.0
Riveted steel, furnished and erected	7.4
Rolled steel, furnished and erected	7.2
Steel rods, furnished and erected	1.0
Underpinning buildings	6.5
Supporting existing railroads	2.7
Construction of new sewers	3.8
Relocating pipes and ducts in streets	2.8
Waterproofing, railroad ducts and miscellaneous	13.1
Total	100.0

Not only is the present higher cost of labor and material reflected in the cost of new subways, but there is an additional expense due to the fact that the later subways are more expensive in themselves, due to the longer stations, the addition of ventilating chambers, and other features brought about by the advance of the art, and to the fact that they have not the right of way, so to speak, that the first subways had. Where they cross the latter, they must be depressed to a great depth, and this adds very materially to their cost. Fig. 8 shows such a condition in the Borough of Brooklyn, and it will be noticed that there are five different levels of transportation represented. Furthermore, the first subways naturally were located in streets favorable for construction. In the lower end of Manhattan there are but few streets left in which subways can be built, and the subways that exist there, in a way, block the construction of other lines. Nor is it possible to avoid such interference by acquiring private property, because of its intensive development and great value. This is well illustrated by Fig. 9, which is a view across Trinity Churchyard towards the Equitable Building, which is typical of much of lower Manhattan. This one building houses, during the working hours of the day, over 13,000 people.

Another element of cost that enters into the problem is the great antipathy to the building of any more elevated lines. The Board of Estimate and Apportionment has stated as its policy that no more elevated lines shall be built in the city. When one considers that these elevated lines cost only one-third or one-quarter that of an equivalent length of subways, it is realized what this means, and the question is raised whether, in those portions of the city which are sparsely developed, some other form of construction than subways cannot be used.

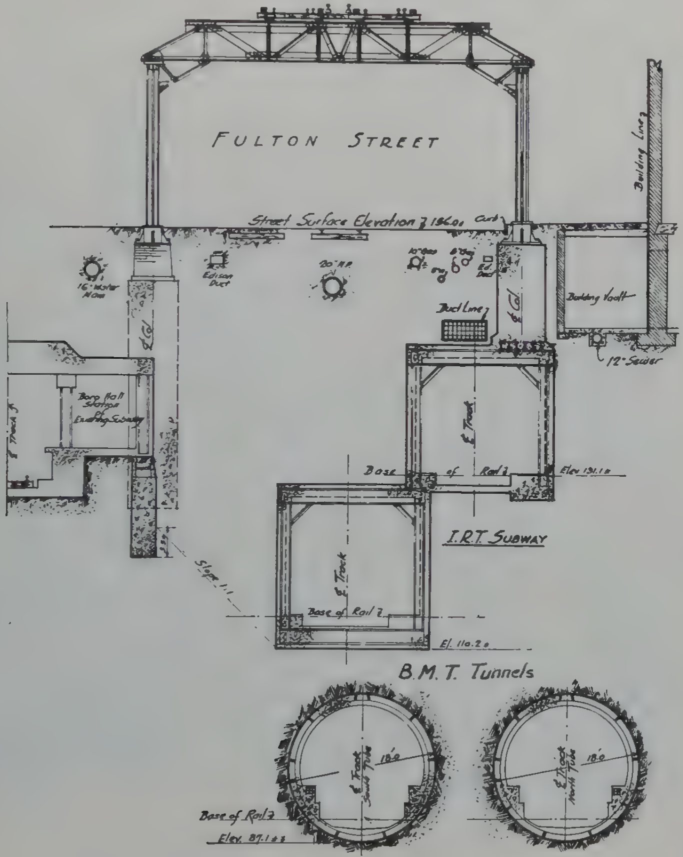

FIG. 8. — FIVE DIFFERENT TRANSPORTATION LEVELS AT ONE LOCATION IN THE BOROUGH OF BROOKLYN

There are several places in the city where similar conditions exist

Consideration has been given in our studies to locating the tracks in open cuts, in the undeveloped portions of the city, the necessary right of way being acquired for the purpose. This bids fair to be adopted in certain parts of Queens at a considerable saving of money over the ordinary form of covered subway. Such a type of construction is shown by Fig. 10, which is one of the lines in South Brooklyn. It was originally a steam railroad operated on the surface over a private right of way. It was absorbed by the Brooklyn Rapid Transit Systems, was reconstructed, and forms one of the rapid transit lines operated under the Dual Contracts. Underground lines consist of either tunnels or subways, and each is subject to many variations in types, as shown by Fig. 11, to meet different conditions encountered. All the types and variations shown have been used in constructing the existing lines, but all are costly.

Photo — General Electric Company

FIG. 9. — EQUITABLE BUILDING AND OTHER LARGE OFFICE BUILDINGS

This view, which is taken looking across Trinity Church yard, is typical of much of the building development in lower Manhattan

There has been much agitation for the past few years on the part of property owners along the line of the Sixth Avenue Elevated Road in Manhattan for the removal of that structure and the substitution of a subway, and the statement has been made by many of the owners of their willingness to be assessed for the cost of such substitution. This is being seriously considered as the solution of that particular problem, and the details of the plan are now being worked out with a view to adopting it. If it proves to be successful there, this principle may be applied to other lines, and its application generally would have the effect of building only such lines as could be amply justified, because owners would object to the assessment unless they thought the lines were necessary; for example, if a two-track line will suffice for a certain branch, and the cost of the line is to be assessed in whole or in part

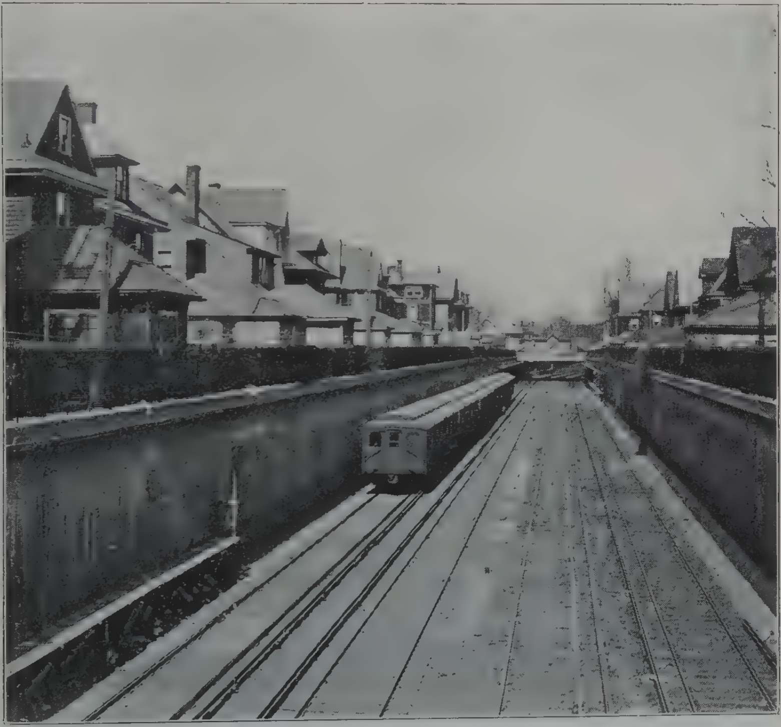

FIG. 10. — STEAM RAILROAD CONVERTED TO RAPID TRANSIT LINE
Electrically operated in open cut in South Brooklyn

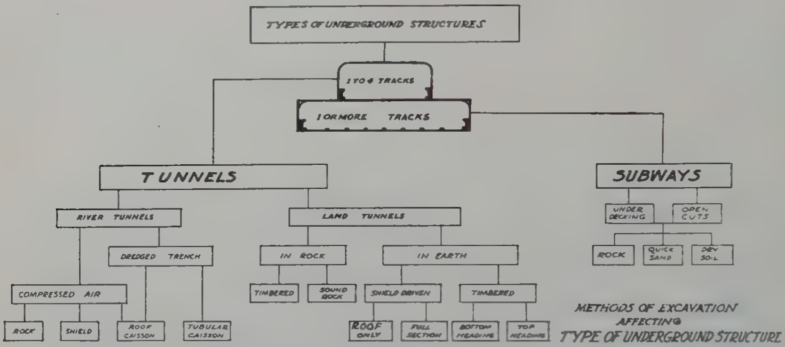

Fig. 11. — Variations in Types and Methods of Constructing Underground Lines to Meet Different Conditions

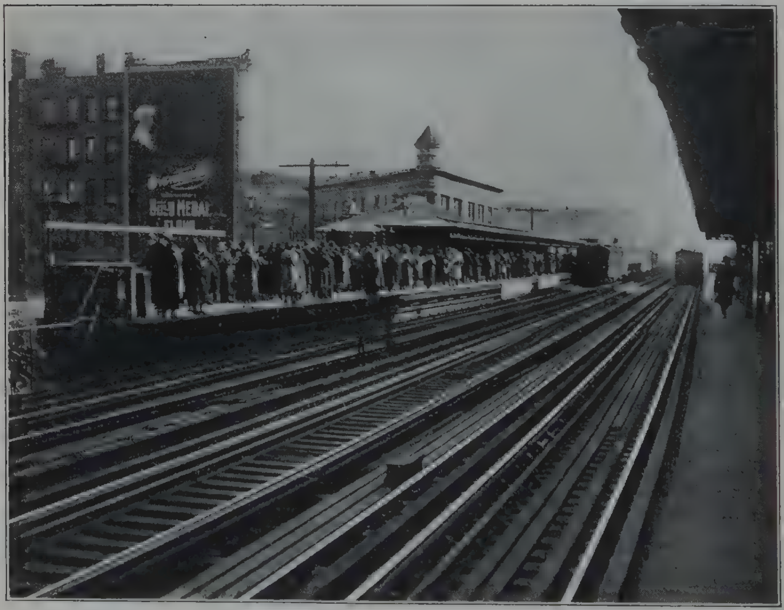

Fig. 12. — Jackson Avenue Elevated Station in The Bronx

Passengers awaiting local train. Typical of many stations on the rapid transit lines during the rush hour against the property benefited, then those who are assessed would probably not be so anxious to have a four-track line built as they might be if the city at large was to pay the whole cost.

The amount and density of the local travel in New York City is hard to visualize except by actual contact with it, and it has constantly increased in spite of — in fact, partly because of — increased transit facilities. The present aggravated conditions are largely due to the fact that no provision for constructing and operating any additional extensive routes has reached the stage of execution since the Dual Contracts of 1913. Fig. 12 shows the congestion on the platform of the local station of the Elevated at Jackson Avenue, in The Bronx. The table which follows shows the total annual local travel, for both street railways and rapid transit lines, since 1860, as compiled by the Transit Commission:

ANNUAL LOCAL TRAFFIC IN NEW YORK CITY, BY DECADES

FISCAL YEAR ENDING JUNE 30	Street Railways	Rapid Transit	Total	Per Capita
1860	50,830,173	–	50,830,173	43
1870	152,463,920	–	152,463,920	103
1880	229,535,272	60,831,757	290,417,029	152
1890	331,243,531	237,906,029	569,149,560	218
1900	603,783,366	242,564,692	846,353,058	246
1910	763,140,739	725,282,196	1,488,422,935	312
1920	941,420,788	1,331,915,745	2,273,336,533	405
1924	1,061,402,247	1,611,538,072	2,672,940,319	448

Only a few of the larger and more important phases of this great problem have been touched upon, and those but lightly, and it is not possible to do otherwise except by confining attention to a single phase of the problem. The magnitude of the work and the area covered are so great that many problems have arisen requiring special treatment, and volumes could be written on construction matters alone. The same applies also to the matter of traffic, to equipment and operation, to finances, and to operating policies, and it is regretted that limitations of time and space prevent entering more fully into some of these interesting questions.

OF GENERAL INTEREST

HIGHWAY AND RAPID TRANSIT PROBLEMS

Plans for Improvement of Boston's Facilities

"In every community in the United States, the traffic problem is acute in some form. The country is beginning to realize that this problem is essentially of an engineering character. This is because, in most places, the local police have reached their limit of accomplishment, and still the problem continues to grow with increasing speed and seriousness. Under these circumstances, it behooves the engineering profession to seriously undertake to meet its responsibility in the matter.

"The problem in each locality is somewhat different from that of every other community. Hence, the best line of approach is for each local engineering society to analyze the problem of its community and then use its best endeavors to co-operate with the local authorities in working out the best possible solution. In this connection, it is likewise important that all engineering groups in the community should work in unison. Therefore, the local society should enlist the active participation of local sections of national societies."

The foregoing paragraphs, which have been taken from a letter recently sent to engineering and technical societies by the Committee on Street and Highway Safety of American Engineering Council, indicate the national scope of the traffic problem.

In recognition of the importance of this subject, the Boston Society of Civil Engineers has planned a meeting for the consideration of "Problems of Highway Operation," to be held on Wednesday, September 30, at which Mr. G. H. Delano, Maintenance Engineer, Massachusetts Department of Public Works, Division of Highways, will be the speaker. His talk will cover many of the practical operating features, such as lights, signs, etc., as well as those of a strictly engineering character. It is expected that a number of the members, familiar with this subject, will contribute a most interesting discussion.

The coming year promises to be an interesting one in Metropolitan Boston in view of the important transit and transportation matters now under consideration.

The Transit Department of the City of Boston is actively engaged in the construction of the Dorchester Rapid Transit Extension. This entire project was described in the January, 1925, JOURNAL of the Society, and a report of progress to date is included in this number.

Studies on a number of matters pertaining to the improvement of highway and rapid transit facilities in Boston and vicinity are being made by the Metropolitan Planning Division. These are outlined briefly in an accompanying article.

The Intermediate Thoroughfare for Boston will be up for action this winter. The Advisory Committee on Public Improvements of the City of Boston has approved this project, and they are planning a publicity campaign this fall in order to acquaint the public with the importance of this large-scale improvement. Most of the members are probably already familiar with other highway improvements recently undertaken at Boston, such as the Stuart Street extension, widening of Cambridge street, the Northern and the Southern Arteries, and the proposed changes in the vicinity of Dock Square.

It is expected from time to time to outline in the JOURNAL *the progress being made along these lines, in the hope that our members will take an active part in furthering them.*

Dorchester Rapid Transit

Section K, Dorchester Tunnel

Proposals were received for the construction of Section K of the Dorchester Tunnel on November 25, 1924, and the contract was awarded to Coleman Brothers, Inc., the lowest of six bidders. Work was begun by them on December 3 and has since been carried on continuously day and night. At the present time their contract is about 90 per cent complete, and it is expected that it will be finished by October, about three months ahead of the contract time.

All sewer and pipe changes have been made and the entire tunnel section has been completed with the exception of the invert under the main line tracks of the New York, New Haven & Hartford Railroad. The new bridge over Dorchester Avenue is finished and is now open for traffic. The work of backfilling and restoring the surface of Boston Street is progressing rapidly.

Section One, Dorchester Rapid Transit

This section starts at the top of the incline at the end of Section K and runs southerly along the main line of the New York, New Haven & Hartford Railroad out as far as Harrison Square, a distance of one and three-quarter miles.

It consists of the construction of a roadbed, together with two station platforms and certain equipment, such as conduits, manholes, etc., for a surface railway extension of the third-rail service of the Dorchester Tunnel. The work includes alteration and construction of bridges, culverts, retaining walls, removal of structures, regrading, etc. The bridges to be built are located at Columbia Road, Savin Hill, Freeport Street Freight Yard and Freeport Street.

The relocation of its main line and freight yard tracks, and the construction of new sidings and spurs by the New York, New Haven & Hartford Railroad Company are involved in this section, and therefore portions of the construction work can be carried on only at certain times. The time in which all construction and equipment work can be done will be divided into three periods, — the first, including all construction and equipment work that must proceed immediately in order to permit the relocation of the steam railroad tracks; the second, including construction and equipment work that must be done during the time in which the railroad is relocating its tracks; and the third, including all construction and equipment work remaining to be done.

Proposals for this work were received at noon of Thursday, August 27, and the contract was awarded to M. F. Gaddis, the lowest bidder. The twelve bids received ranged from a maximum of $879,595 to the bid of M. F. Gaddis which was $530,380.

Metropolitan Planning Division Active

As a part of its general work, the Metropolitan Planning Division is engaged in plans for a comprehensive highway layout for the Metropolitan District. This is a matter of gradual achievement and takes the form of improvement of existing routes of traffic, both radial and circumferential, and the connecting up of missing links between roads or streets so as to form additional through traffic ways. One aim of the Division is to present to the Legislature each year several important highway improvements which are distinctly of a metropolitan character.

Another branch of its work consists in the planning of improvements in the rapid transit facilities of the district. This work requires the taking into consideration of the needs of the city for a considerable period of the future. Numerous studies are under way for rapid transit extensions by subway and in private rights-of-way which if consummated will, it is hoped, provide the Metropolitan District with entirely adequate rapid transit.

The Legislature of 1925 passed several special resolves relating to the Metropolitan Planning Division, some of which are as follows:

Chapter 35 called for an investigation by the Metropolitan Planning Division and the Transit Department of the City of Boston, sitting jointly, relative to the construction of a subway for the rapid transit lines of the Boston Elevated Railway in the vicinity of Huntington Avenue and Stuart Street. It is recognized that the traffic over the surface lines in the territory tributary to such a location is increasing, and the joint commission is considering a number of plans and routes which, it is hoped, will effectively provide for improvements in the service in that locality.

Chapter 36 provided for a further investigation by the Planning Division relative to a transfer station west of Harvard Avenue in the Allston district of Boston, and to provide rapid transit to Boston through Cambridge and Somerville. These matters were studied last year and certain recommendations made. Further studies are now under way and will be reported to the Legislature early in December.

Chapter 37 directed the Planning Division to study and consider relative to the problems regarding the transportation facilities existing between Boston proper and East Boston. This involves a study of the services afforded by the present East Boston rapid transit tunnel, by the ferries operated by the city, and by the Boston, Revere Beach & Lynn Railroad, and the possibilities of additional facilities by teaming subways under the harbor or by a bridge across the waterway. An exhaustive report on vehicular subways beneath the harbor was made by the Department of Public Works and the Transit Department of the City of Boston sitting jointly in 1921. As an alternative to such subways the Division is investigating the possibilities of an overhead suspension bridge with approaches which would connect with the proposed Intermediate Thoroughfare on the Boston side and in East Boston at a point where various radial streets concentrate, and which would afford convenient outlet to the North Shore if some widenings were made and improved pavements laid.

Study of Culvert Pipe

Announcement is made by Chas. M. Upham, Director of the Highway Research Board of the National Research

Council, of the commencement of a new investigation by that Board on culvert pipe; and that R. W. Crum, Engineer of Materials and Tests, Iowa State Highway Commission, has been designated chairman of that investigation. The objects of this study are: to correlate the various tests and experiments on pipe loads and stresses; to set up a standard of comparison of the life of different kinds and classes of culvert pipe; and to determine the most probable conditions of service for which standards should be designed.

On French Bridges

By Frederic N. Weaver, Assistant Professor of Civil Engineering, Tufts College

The traveler in France, whether engineer or layman, must of necessity be impressed by the number and variety of arches he encounters on his journeys. From the whole summer of 1924 the writer remembers but one beautiful scene marred by an ugly steel railroad bridge. The scores of Paris bridges, varying from the massive Pont Neuf to the more modern and graceful single spans, are well known; but as the tourist turns to the provinces he still finds major rivers and unknown valleys crossed by single arches or lofty viaducts. In the Alps his cog-railroad clings to the mountain on multiple arches, and miles from the nearest village he finds gorges spanned by delicate arches which are an integral part of the scene. The arch, whether to carry highway or railroad, seems to be the standard structure; all others must justify themselves.

"What is the reason?" the layman asks, and the engineer replies, "Economy. France has her own cement stores. Concrete, stone, and labor are relatively cheap. Arch bridges are permanent structures with minimum maintenance costs. Stone works to the best advantage in this form — hence the ubiquitous arch bridge."

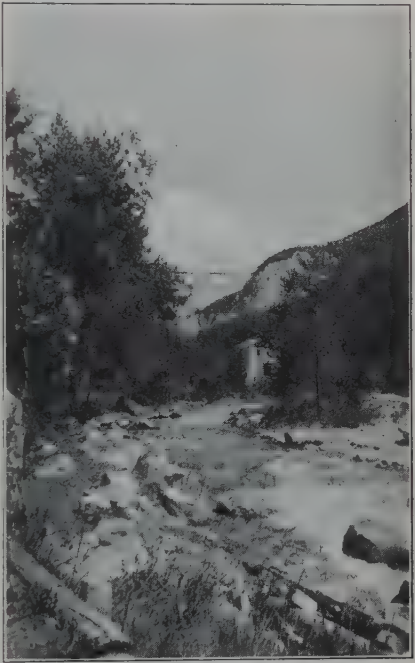

Fig. 1. — Steel Highway Bridge near Briançon

I wonder. I venture to say that even if in the last analysis steel were the more economical, still it would not be used, in our usual unsightly form, near large cities nor on scenic lines such as the automobile road through the French Alps to the Mediterranean. Let us dip into French engineering literature.

"It seems banal to state that a masonry bridge is a monument of public utility. . . . As a public monument it must be a lesson in beauty, harmony, force, while its utilitarian character demands simplicity of line and economy compatible with beauty. . . . Not unrarely is the most beautiful solution the most economical. . . . We must insist that unless insurmountable difficulties of execution prevent, only the most pressing economical reasons should compel us to substitute the steel for the concrete bridge. We must stress the point." *

This is the answer. Strength is not neglected, — witness the investigations of French engineers into deflections and methods for relieving initial stresses, — but beauty and line come first.

We note with pleasure that this view is now obtaining more and more in our own country, and thus this article is not merely a plea for a more rational and liberal viewpoint. Rather it is a reminder that public works are built for posterity; that almost any structure may in a broad sense be considered a public work; and that these may be made inspirations. To this end let us remember that the Pratt truss is not the only device by which to span between two abutments.

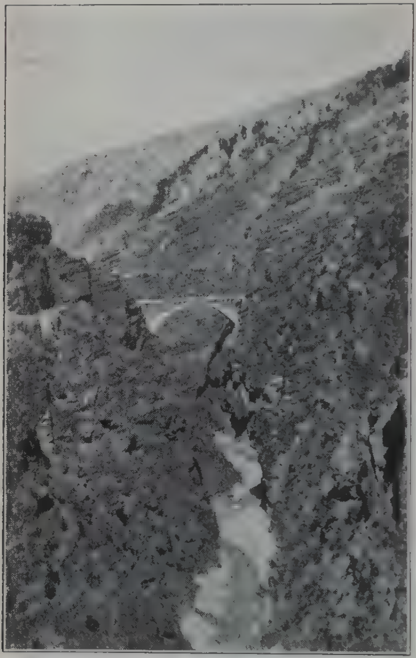

Fig. 2. — Concrete Bridge, the Dalvis Gorges, Southern French Alps

PROCEEDINGS OF THE SOCIETY

MINUTES OF MEETINGS

June Outing

For the past two seasons the June excursion of the Society has met with decidedly inclement weather. On June 25, 1925, the New England Water Works Association and the Boston Society of Civil Engineers joined in a trip to inspect the $20,000,000 project under construction for the New Providence Water Supply. The party assembled in the rain in the square back of the railroad station at Providence and proceeded by automobile procession to the site of the 50,000,000 gallon filter plant and the Scituate dam, making a brief stop at a pumping station in the city.

Owing to the steady drizzle, the plans for an outdoor buffet lunch had to be abandoned, and the lunches were served in the engineering headquarters building near the dam. Although there was a little confusion and delay due to the necessity of serving about 300 persons under adverse conditions, this was taken in good part by those present who realized the exigencies of the situation.

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* Ponts en Maçonnerie, C. Gay, Ingénieur de la Cie. des chemins de fer P. L. M.

After lunch most of the members visited the dam, which is nearly completed. This dam, which is built of earth, is of great size and will create a reservoir of 3,600 acres, the flooding of which will begin during the summer of 1925.

Those who attended the trip this year and also the one last year to the new Edison Station at Weymouth will all agree that June is a fickle month in which to expect the sun to shine on a B. S. C. E. Excursion.

J. B. Babcock, *Secretary.*

APPLICATIONS FOR MEMBERSHIP

[September 15, 1925]

The By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of twenty (20) days from the date given.

For Admission

Bateman, Henry J., Dorchester, Mass. (Age 25, b. South Boston, Mass.) Graduate of South Boston High School, 1919. Employed by Monks & Johnson, 1919–22; during this time attended Franklin Union and Lowell Institute building courses. From 1922–24 was in the employ of Canter Construction Co. In 1923 took course in estimating at Franklin Union, and in May, 1923, passed city of Boston examination for class A, B, C building license. Has had experience in wood, brick, stone; structural steel and reinforced concrete. At present superintendent for P. Rich & Son. Refers to Henry Felderman, Charles Freed, J. J. Harty, H. C. Sheils.

Johnson, Hans M., Medford, Mass. (Age 50, b. Germany.) Educated in a polytechnical school. Has been in civil engineering work for the past twenty-four years, and has built stores, garages, and some frame buildings. Holds a building license in Boston, A, B, C. Is engaged in civil engineering work and contracting. Refers to N. J. Holland, W. A. Johnson, W. J. Sullivan, F. O. Whitney.

Malkasian, Zaven, Watertown, Mass. (Age 19, b. Brighton, Mass.) Entered Northeastern University in fall of 1923; during the past two years he has worked for C. H. Gannett in the five-week intervals in connection with school work. Refers to H. B. Alvord, C. S. Ell, C. J. Ginder, J. W. Ingalls, W. E. Nightingale.

Sprott, Howard Judson, Cambridge, Mass. (Age 22, b. Boston, Mass.) At present in the senior class at Tufts Engineering School. Refers to Robinson Abbott, H. P. Burden, W. J. Downer, E. R. McCarthy, F. B. Quinn, E. H. Wright.

For Transfer from Junior

Chase, Hugh D., Newton, Mass. (Age 27, b. Unity, Me.) Graduate of Mass. Inst. Tech., 1923. Entered the employ of New England Tel. & Tel. Co., in July, 1923, general engineering department. After a three-months training course was located in Engineering Department on Fundamental Plans, and is now in charge of ultimate routing plans and ultimate conduit plans under direction of Acting Chief Engineer. Refers to J. B. Babcock, G. L. Hosmer, J. W.

Howard, A. G. Robbins, C. M. Spofford, Hale Sutherland.

Coogan, Thomas P., Winthrop, Mass. (Age 27, b. Springfield, Mass.) Was in U. S. Navy Air Service, 1917–19; 1919–20, Chauncy Hall School; 1920–21, Mass. Inst. Tech.; 1921–23, Lowell Institute; 1921 to date, with the National Waterproofing Co., Boston. Refers to R. H. Lindgren, W. F. Pike, H. C. Sheils.

Dresel, Ralph R., San Francisco, Cal. (Age 26, b. Cedarhurst, N. Y.) Graduate of Mass. Inst. Tech., 1924. Assistant instructor in civil engineering, M. I. T. October, 1923, to June, 1925. At present safety engineer, service department, Federal Mutual Liability Insurance Co. Refers to H. L. Bowman, G. L. Hosmer, J. W. Howard, A. G. Robbins, C. M. Spofford.

Drew, Samuel T., Wollaston, Mass. (Age 26, b. Wollaston, Mass.) Graduate of Mass. Inst. Tech., 1921. From 1921–22 assistant engineer with Metcalf & Eddy; 1922–23, assistant in water power engineering at M. I. T.; 1923 to date, assistant engineer with Metcalf & Eddy. Refers to H. K. Barrows, H. P. Eddy, Jr., J. W. Raymond, Jr., A. L. Shaw.

Hill, Henry F., Jr., Brookline, Mass. (Age 26, b. North Whitefield, Me.) Graduate of University of Maine, 1922, with B.S. degree. Assistant to City Engineer, Augusta, Me., during the summers of 1917, 1918 and 1919; summer of 1920, draftsman for Maine Highway Commission; summers of 1921 and 1922 (until January, 1923) inspector and engineer for Maine Highway Commission; from January, 1923, to date, junior engineer assigned to Water Resources Branch of U. S. Geol. Survey, New England District. Refers to W. E. Armstrong, H. S. Boardman, S. S. Kent, C. H. Pierce, P. A. Shaw, D. M. Wood.

Richards, Walter C., Providence, R. I. (Age 26, b. Weymouth, Mass.) Graduate of Northeastern University, 1921, with degree of B.C.E. Previous to graduating he was employed on a part-time basis by the following: Whitman & Howard, on surveys as rodman and transitman, two years; Northeastern University, as assistant in civil engineering, one year; six months with city engineer, Putnam, Conn.; after graduation, with the Department of Public Works as assistant resident engineer and later as resident engineer; May, 1922, to date, with Turner Construction Co. Refers to H. B. Alvord, R. W. Coburn, C. S. Ell, Channing Howard, W. E. Nightingale, H. C. Thomas, A. C. Tozzer.

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Joseph F. Pagliarulo, 42 Maverick Street, East Boston, Mass.

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DEATHS

George M. Clukas	June 28, 1925.
Willard M. Foster	July 5, 1925.
Charles W. Eaton	July 21, 1925.

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Street Traffic Control. McClintock *

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* Gift of McGraw-Hill Book Company. To be reviewed next month.

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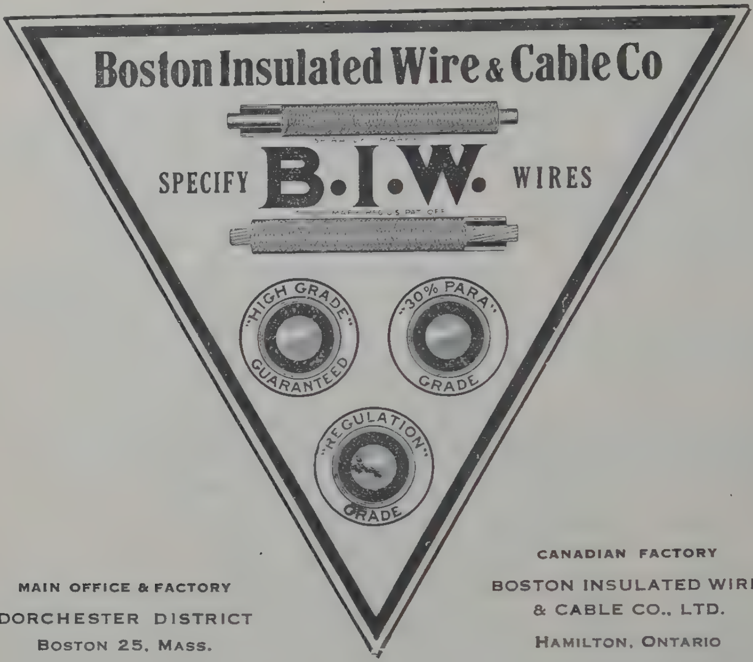

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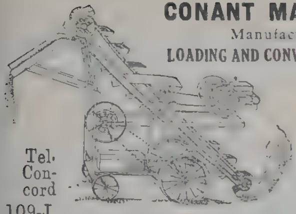

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